Access to Finance and Growth of Innovative SMEs after Brexit

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ABSTRACT

This paper offers a new perspective on the link between the literature on firms' investment decisions during period of uncertainty and the literature on access to finance for innovative Small and Medium Enterprises (SMEs). In particular, it provides nuanced evidence on innovative SMEs' expectations of access to debt finance and growth after Brexit. By using a unique survey, we find that innovative SMEs expect to be more financially constrained. Furthermore, the results show that innovative SMEs have not only changed their strategies by cutting their employment, but also expect lower growth. Finally, the findings suggests that there is a spatial bias in the financial system: innovative firms outside London in fact expect to be more financially constrained and to grow less in response to Brexit.

Keywords: Innovative SMEs, Brexit, Financial Constraints, Growth
JEL classification: G20, G32, L26

I. Introduction

After the outcome of the 23 June 2016 national referendum, the UK will leave the EU's membership (so-called Brexit) on Friday 29 March 2019. Since the referendum, there has been considerable uncertainty among policy makers and scholars on the costs and consequences of Brexit for the British economy. The prevailing view is that the UK will be negatively affected because of new barriers to trade and migration between the UK and the European Union (Sampson, 2017; Dhingra et al., 2016). Furthermore, the Brexit negotiations between the EU and the UK and the lack of clarity in terms of practical implications of Brexit have both induced political and economic uncertainty. While this has brought instability in key financial markets (Belke et al., 2018), its effects on the industrial sector are still debated. The uncertainty regarding the relationship between the UK and both the EU and North America can affect the way British companies and entrepreneurs deal with their businesses, create new companies, and how incumbent British companies and new ventures interact with their international partners (Cumming and Zahra, 2016). Moreover, uncertainty about future sales can strongly affect firms' current investment and employment decisions (Bloom et al., 2017). In this context, SMEs and especially firms operating in the hi-tech and service-related industries appear to be particularly concerned regarding the consequences of Brexit for their growth (Wilson and Brown, 2018). Yet there is relatively little attention about how and the extent to which the uncertainty associated with Brexit can affect small innovative firms in particular. This paper covers this gap and contributes to the debate by providing new insights on innovative SMEs' expectations of future access to debt finance and growth after the Brexit. Furthermore, despite access to finance having been an important area of government interventions since the 2008 financial crisis, there are still longstanding concerns about the support provided to innovative firms by the UK financial system (Lee et al., 2015;Hutton and Lee, 2012). This is motivated by the fact that innovative small firms have faced more barriers to access to finance since the credit crunch and innovative investment follow a cyclical pattern (Lee et al., 2015). In this context, the uncertainty associated with Brexit could potentially further restrict small innovative firms' access to finance and growth. This paper provides new insights on these issues and therefore offers several contributions to the literature on access to finance.

First, this is the first paper so far that empirically examines how access to finance for innovative SMEs has changed after Brexit. Particularly, we explore whether innovative SMEs expect to grow less and at the same time adjust their strategies to accomodate Brexit by using a unique survey.

Second, by bridging the literature on access to finance and investments in periods of

uncertainty, we consider the association between the expectation of being more financially constrained and to grow less for innovative SMEs. This analysis is motivated by the fact that previous studies have shown that when financial constraints become more acute, SMEs' growth rates are slower (twice as much even) when compared to those of large firms (Beck et al., 2005). In addition, in a recent empirical literature review, Kersten et al. ((2017)) find that access to finance significantly matters for the increase of SMEs' capital investment, performance and employment.

Third, we explore whether the perceived access to finance and growth for innovative SMEs after Brexit vary geographically. A new stream of research has paid specific attention to the impact of the geography of the UK's banking system on access to finance of UK SMEs (Lee and Brown, 2016; Zhao and Jones-Evans, 2016). They show that there has been a reduction of financial flows for SMEs in peripheral regions.

This paper contributes to this literature by also offering new evidence on the perceived access to finance and growth for innovative SMEs outside London after Brexit. The effect of Brexit on both access to finance and growth for innovative SMEs is not straightforward. On the one hand, London as a large city and financial centre tends to offer better credit market and attracts labour forces, business, specialised corporate services and major financial institutions. Instead, peripheral regions do not exert the same appeal on financial institutions and business (Degl'Innocenti et al., 2018). Based on this view, it is likely to find more financial constraints for SMEs outside London. On the other hand, the role of London as the world leading financial centre is likely to be harmed by Brexit with the consequent exodus of companies and investors abroad (Cumming and Zahra, 2016). This effect could reduce the big city bias of London in credit markets. Therefore, we could expect to observe less differences in terms of access to finance and growth between SMEs inside and outside London.

Fourth, from a methodological viewpoint, we employ a trivariate probit model that allows us to jointly consider SMEs' changes of strategies (in terms of investment plans, exports and employment), their expectations of future growth and their expectations of financial constraints after Brexit. These three factors can indeed influence one another. Finally, we perform an additional test to exclude that the expectation of being financially constrained after Brexit is driven by the fact that SMEs have been financially constrained in the past.

Our main findings show that innovative firms- those introducing new products, services or processes- have already changed their strategies, for example, by cutting employment, and expect to be more financially constrained and to grow less. Furthermore, we find that the innovative firms located in Southern England, the Midlands and in Northern England expect to be significantly and negatively affected by Brexit in terms of access to finance and

growth.

These results offer policy implications. As long as innovative firms will perceive to be more financially constrained after Brexit, they could be more discouraged from applying for external finance. In turn, this will reduce their innovative investments and harm their growth. As a consequence, British economic growth could slow down as SMEs are responsible for 60% of the private sector employment and 51% of the turnover in the UK. Among them, innovative firms play an important role for economic recovery.

The remainder of the article is organised as follows. Section II revises the literature on access to finance and growth for SMEs in periods of uncertainty. Section III provides data and methodology description. Section IV presents the main empirical evidence. Section V shows additional analysis on the geographical location, changes to sales' expectation and the decrease of employment of SMEs in response to Brexit. Section VI concludes.

II. Access to finance and growth for innovative SMEs in period of uncertainty

A plethora of studies agree that SMEs and especially innovative firms are financially constrained and do not easily get access to debt finance. This is because SMEs are opaque as they do not usually have audited financial information and traded debt or equity (Duqi et al., 2017). Furthermore, they do not exhibit the scale to diversify their investment portfolio as large firms do (Lee et al., 2015). This makes them a risky investment for financial providers. Innovative small firms are even more financially constrained as investments in innovation are hard to measure, costly to re-deploy, and characterized by uncertainty regarding their future rent and successful commercialization (Freel, 2007; Hall and Lerner, 2010 and Minetti et al., 2015). Moreover, innovative firms have a superior knowledge of the nature and characteristics of the innovative investments than the potential financial providers. Consistent with the classical lemon problem, this makes it particular expensive for innovative firms to get access to debt or equity as financial providers tend to ask for a high premium.

Periods of uncertainty and economic downturn can make even more difficult for innovative firms to get access to finance compared to other firms (Cowling et al., 2015)[1]. This is motivated by the fact that both investments in innovation and access to finance follow a cyclical pattern (Lee et al., 2015). Particularly, during periods of uncertainty, firms experience a drop in their demand of products/services. This has a detrimental effect on their balance sheet and consequently on their availability of internal finance. As internal resources

[1]Uncertainty usually indicates uncertainty about future productivity/profit and demand condition after major political and economic shocks (Bloom, 2007;Bloom et al., 2007).

run out, firms demand more external finance to be able to bring products to market and benefit from a return to economic growth (Cowling et al., 2015; Lee et al., 2015). Despite innovative firms' reliance on external funds, they are paradoxically more likely to see their loan application rejected as bank lending shrinks during economic downturn (Behr et al., 2017). Consistently, recent empirical studies (Cowling et al., 2015; Lee et al., 2015) have shown that small firms, and especially innovative firms, have worsened their access to finance during and after the financial and market uncertainty generated by the 2008 financial crisis (GFC). As a consequence of a more severe credit rationing, small firms can also search for alternative external finance. For example, by using a Euro area firm-level data after the GFC, Casey and O'Toole ((2014)) show that bank lending-constrained SMEs are more likely to use or apply to alternative external finance such as trade credit, informal lending, loans from other companies, market financing (issued debt or equity), and state grants. Other financial channels such as lending-based crowdfunding or peer-to-peer (P2P) lending are now seen to be a valid substitute tool to the traditional loans, especially for innovating entrepreneurs (Bottiglia, 2016; Stanko and Henard, 2017). However they still cover a relatively low percentage of external finance for firms compared to bank loans and leasing. Bank loans and leasing still account for the highest share of external finance (respectively 56% and 21%) [2]. Therefore, access to debt finance remains a crucial issue for small innovative firms especially during uncertain periods. This can contribute to increase their perception of being more financially constrained compared to less innovative firms. By drawing on these considerations, we therefore expect to see a decrease of confidence in getting access to finance in response to Brexit especially for innovative firms. Therefore, we formulate the following hypothesis:

H1: Innovative SMEs expect to be significantly financially constrained as a result of Brexit.

Getting access to external finance is crucial for SMEs' growth as these firms mainly rely on external debt finance and have a shortfall of internal resources to successfully commercialise innovations (Beck and Demirguc-Kunt, 2006). The joint effect of drop in the demand of products/services and the increase of financial constraints can prevent firms from investing. In periods of uncertainty, firms prefer to curtail their investments or postpone them until a recovery trend occurs (e.g. Ghosal and Loungani, 2000; Bulan, 2005; Bloom et al., 2007; Czarnitzki and Toole, 2011). In particular, the existence of imperfect appropriability conditions of innovations can pursue firms to reject or scale down R&D projects (Ghosal and Loungani, 2000; Meuleman and De Maeseneire, 2012). The reason is that exploratory

[2]European Investment Bank (EIB), 2017. EIB Group Survey on Investment and Investment Finance: EU overview. Available from *http* : $//www.eib.org/attachments/efs/eibis_2017_european_union_en.pdfwww.ipsos-mori.com/$.

innovative activities involves a high degree of uncertainty that is likely to increase firms exposure to fail (D'Este et al., 2017). In period of uncertainty, the risk of failure could rise as well. Consequently, firms can be more reluctant to increase their innovative investments as these activities are seen to be fully irreversible as they convey toward the salaries of research personnel and the purchase of task-specific equipment and materials (Czarnitzki and Toole, 2011). Instead, they tend to put forward deeper cuts in tech spending, employment, and capital spending and tend to bypass attractive investments (Caggese, 2012; Cowling et al., 2015). This could hamper growth in employment, sales, exports, and economic welfare (Feldman and Kelley, 2006).

We therefore argue that the joint effect of uncertainty for the demand of services and products and the perceived increase of financial constrains is likely to be associated with a negative expectation of growth. Because of their business characteristics, we also predict that especially innovative firms can expect to be more strongly affected by uncertainty in terms of growth perspective than other firms. Thus, our second and third hypotheses are as follows:

H2:There is a positive association between the expectation of being financially constrained and to grow less.

H3: Innovative SMEs expect to grow less than non-innovative firms in response to Brexit.

III. Data and methodology

To the best of our knowledge, this is the first study using the Business Finance survey conducted in 2016 by the British Business Bank (BBB). The BBB is a state-owned bank founded in 2014 with the objective of increasing the supply of credit to SMEs. Compared to other surveys (for example SAFE), this survey collects detailed information on SMEs' debt finance needs and the specific actions they take. The survey was conducted between 25th October and 22nd November 2016 through computer-assisted telephone interviewing with individuals responsible for managing business finance. The final sample comprises 1,535 English SMEs.

First, we analyse which SMEs' characteristics are related to the expectation of being financially constrained after Brexit. Particularly, we use an ordered probit model where the dependent variable measures the degree of difficulty that England-located SMEs expect to face in obtaining debt finance after Brexit. Second, we control whether the expectation of being financially constrained after Brexit is driven by the fact that a SME has applied and not received any debt finance in the previous three years (*Constraints*). Particularly, debt

finance includes: bank finance (bank overdraft, bank loan, bank mortgage) and non-bank finance (government or local government grants, loans from friends and family, loans from directors, loans from other parties, leasing or hire purchases, invoice finance or factoring, credit cards, finance from government scheme, international trade office, equity finance, mezzanine finance, peer to peer lending, corporate bonds). Finally, we analyse which SME characteristics are related to the expectation of less growth after Brexit. We employ a trivariate probit model because this enables us to jointly consider SMEs' changes of strategies (in terms of investment plans, exports and employment), their expectations of future growth and their expectations of financial constraints after Brexit, as these three factors can influence one another. In line with previous studies (Handley and Limo, 2015; Ghosal and Ye, 2015), uncertainty shocks can lead to a decrease in investments and employment, especially for SMEs. To test these hypotheses, we extend our analysis by using the following system of equations:

$$\begin{cases} \text{Financing\_expectation}_i = \beta' X_i + v_{1,i} \\ \text{Growth\_expectation}_i = \gamma' X_i + v_{2,i} \\ \text{Strategy\_changes}_i = \zeta' X_i + v_{3,i} \end{cases} \tag{1}$$

where *Financing_expectation* is equal to 1 if a firm expects to face more difficulties in obtaining debt finance after Brexit, otherwise it is equal to 0. *Growth_expectation* is a binary variable that is equal to 1 if a firm expects to grow less after Brexit, otherwise it is 0. *Strategy_changes* is a binary variable that is equal to 1 if a firm has already changed its strategy after Brexit, in terms of investment plan, number of employees and export. *Innovation* is equal to 1 if a firm introduced new or significant improved goods and services/processes over the last three years)

The error terms $v_{m,i}, m = 1, ..., 3$ follow a trivariate normal distribution. Consistent with previous studies on SMEs' access to finance (Beck et al., 2006 and Lee and Brown, 2016), we include the following control variables for SMEs' characteristics: *Firm age*($\leq$5) (equals to 1 if less or equal to five years); *Firm age*($\geq$10) (equals to 1 if more than 10 years); *Export-oriented* (equals to 1 if firm has exporting income); *Turnover*($\leq$ £50K) (equals to 1 if firm's turnover is less than £50,000 in the past 12 months); *Turnover*($\geq$ £10M) (equals to 1 if turnover is more than £10 million). We also control for a firm's industry type (*Business service*, *Manufacturing sector* or *Other service*); firm's location (*London* and *Northern England*), and firm size (*Sole proprietorship* (no employee), *Micro firm* (1-9 employees), and *Small firm* (10-49 employees)). A detailed definition of the variables is reported in Table I

[insert Table I about here]

As shown in Panel A of Table II, almost 50% of SMEs believe that it will be more difficult to get access to debt finance after Brexit. Particularly, 37% of SMEs think the access to debt finance will be a little more difficult, while almost 13% believe it will be a lot more difficult. Almost 43% do not think they will be affected. Panel B of Table II reports the descriptive statistics of the explanatory variables. Columns 1-3 of Panel A show that 45% of firms carry on innovative activities (*Innovation*). In addition, almost 70% of firms are at least 10 years old (*Firm age* $\geq$*10*), while young firms represent almost 14% of the sample, (*Firm age* $\leq$*5*). In addition, 60% of the firms are either sole proprietorship firms or micro firms, while almost 20% of firms have a relatively low *Turnover*($\leq$ £50*K*). Finally, almost 30% of the firms are export-oriented (*Export-oriented*) and located in Northern England (*Northern England*).

[insert Table II about here]

Table III shows the pair-wise correlation matrix. We do not obverse a high correlation between each pair of our independent variables[3].

[insert Table III about here]

IV. Results

A. Main Results

Model 1 in Table IV analyses how firm level characteristics affect expectations of access to debt finance after Brexit. Model 2 includes a dummy (*Constraints*) that is equal to 1 if a SME has been financially constrained in the past three years. Finally in Model 3, we explore the association between being financially constrained, expecting low growth and changing strategies. In all these models our focus is on underpinning which SME has been already affected or expects to be affected by Brexit. By focusing on Model 1, we find a positive and significant coefficient (β=0.119, p-value: 1%) between *Innovation* and the expectation of being financially constrained (*Diff*). Consistently with our *H1*, this means that innovative SMEs expect to be more financially constrained than non-innovative firms. Furthermore, our findings show that firms that are young (*Firm age* $\leq$ 5 *Years*) and micro-sized (*Micro firm*) expect to be significantly less successful in getting access to debt finance. For these variables we find respectively a positive and significant coefficient (β=0.240, p-value: 1% for *Firm age* $\leq$ 5 *Years*; β=0.153, p-value: 5% for *Micro firm*). This offers an important warning signal since young firms are not usually concerned with growth, but more with business survival (Cowling et al., 2015; Watson et al., 2003). These results are consistent with

[3]This is also confirmed by the variance inflation factor (VIF) that is not higher than 4 in any model.

previous studies that suggest that young and innovative firms tend to be more financially constrained than other firms (Canton et al., 2013; Lee et al., 2015 and Lee and Brown, 2016). Furthermore, both *London* and *Northern England* exhibit a positive and significant coefficient (respectively β=0.197, p-value: 1%; β=0.161, p-value: 1%). This means that firms in both these locations expect to be significantly more financially constrained after Brexit. Furthermore, these findings only partially reflect the results of the Brexit vote. For example, the Remain vote was strongest in London and was mixed in the North of England (Becker et al., 2017). However, firms in the Northern England appear to be highly concerned about Brexit.

In addition, firms operating in *Other services* (non-business service) expect it would be more difficult to access debt finance (β=0.183, p-value: 1%). This is not surprising as this sector is likely to be particularly adversely affected by an exit from the European single market. In contrast, we find that the *Manufacturing sector* is negatively and significantly associated with expectations of debt financial constraints after Brexit (β=-0.131, p-value: 1%). This result could perhaps be explained by the fact that the manufacturing production increased in the months following the Brexit referendum.

Finally, *export-oriented firms* are significantly confident that they will be less financially constrained as the coefficient is significantly and negatively related to *Diff* (β=-0.091, p-value: 1%). A possible explanation might be that exporters usually produce higher quality goods and tend to sell at higher prices than non-exporters (Hallak and Sivadasan, 2013). This could reduce asymmetric information problems with financial providers and enhance their confidence of being less financially constrained after Brexit.

Firms' expectations of financial constraints after the Brexit could be explained by firms' previous experiences of financial constraints. To address this concern, we create a dummy variable that is equal to 1 if firms applied for debt finance but did not get any funds in the past three years[4]. Model 2 shows that the coefficient of the *Constraints* variable is not significant. This suggests that concern for the Brexit's consequences in terms of access to debt finance is not explained by past experience. Furthermore, *H1* is still confirmed.

In Model 3, we employ a trivariate probit model to consider the reciprocal influence among SMEs changes of strategies (in terms of investment plans, exports and employment), their expectations of future growth and their expectations of financial constraints after Brexit. Consistently with *H2*, our results suggest that there is a significant and positive association between these three factors. In particular, $\rho_{v1,v3}$, $\rho_{v2,v3}$ and $\rho_{v1,v3}$ are positive and significant at 1% (respectively equal to 0.38, 0.36 and 0.54). Particularly, *Innovation* impacts positively

[4]Due to missing values for the explanatory variable *Constraints*, the number of observations in Model 2 is lower than that in Model 1.

and significantly on *Diff*, *Growth* and *Change* with the following coefficients: 0.191***, 0.221**, 0.353***.

These findings provide support for our *H3* that argues that innovative firms are more concerned about Brexit for their growth compared to less innovative firms. In addition, we also find that firms located in *London* are more likely to change their current strategies (e.g. by cutting employment, reducing investments) given their expectation to be more financially constrained and at the same time to grow less. *Export-orientation* is a positive and significant predictor of changes in strategies (β=0.424, p-value: 1%) and expectations of reduce future growth (β=0.148, p-value: 10%), although it is negatively associated with expectations of being financially constrained. Yet, manufacturing firms are optimistic regarding their growth prospects after Brexit.

[insert Table IV about here]

B. Regional Dimension

Over the last decade the structure of the UK banking system has changed profoundly as a result of financial innovations, institutional change, and the global financial crisis. From one hand, there has been an increase of spatial agglomeration of financial services and institutions in metropolitan areas (Wójcik and MacDonald-Korth, 2015), especially in the financial centre of London. On the other hand, banks have consistently reduced their number of branches with a consequent increase of both the average distance between bank branches and small businesses (that more than others benefit from the proximity) and bank branches and headquarters. All these structural changes to the regional financial ecosystem have complicated SMEs access to finance (Lee and Brown, 2016 Zhao and Jones-Evans, 2016). Particularly, Zhao and Jones-Evans ((2016)) show that that greater functional distance between bank headquarters and branches enhances the credit constraints of local SMEs. Instead, Lee and Brown ((2016)) find that innovative firms in peripheral regions are more likely to have their applications for finance rejected, even when considering factors such as credit score. Finally, they find that innovative firms in peripheral regions are more likely to be discouraged from applying for external finance. More in general, the proximity between lender and small business play a crucial role. As the financial system looses its local branches and institutions, getting access to external finance become more difficult for small firms (Alessandrini et al., 2008; Berger and Udell, 1995; Berger and Udell, 2006). More in general, capital tends to be more available in very successful economic areas than others. For example, venture capital markets appears to be geographically dominant in London, the South East, and the East of England compared to other regions (Hutton and Lee, 2012). Therefore, we could expect a

geographical bias in the capital flows available to SMEs.

By drawing on these considerations, we explore the geographical variations of SMEs' characteristics that expect to be more financially constrained and grow less after Brexit. The scope is to underpin whether and to what extent Brexit can potentially widen the financial gaps between innovative small business in different regions. Our results show that innovative firms located in *Southern England & Midlands* are more likely to adjust their strategies based on their expectations to be more financially constrained and to grow in response to Brexit. The coefficient of *Innovation* is positively and significantly related to the dependent variables (β=0.165, p-value: 1% for *Diff*; β=0.234, p-value: 1% for *Growth*; β=0.234, p-value: 1% for *Change*). We also notice that innovative firms located in *Northern England* also expect to be more financially constrained and have already changed their strategies in response to Brexit. The coefficient of *Innovation* is positively and significantly related to *Diff* (β=0.152, p-value: 1%) and to *Change* (β=0.380, p-value: 1%). Instead, innovative firms located in *London* are not significantly concerned regarding access to finance and growth. We also notice that manufacturing firms located in London expect to be more financially constrained compared to those firms located in *Southern England & Midlands* and *Northern England*. Finally, we find that the association between the expectation of being more financially constrained and growing less, and changing strategies is strongly positively significant in the case of *Southern England & Midlands* and *Northern England*. In particular, $\rho_{v1,v3}$, $\rho_{v2,v3}$ and $\rho_{v1,v3}$ are equal to 0.34***, 0.20* and 0.46*** for *Southern England & Midlands* and respectively equal to 0.40***, 0.51*** and 0.58*** for *Northern England*. Thus, our findings suggest that innovative SMEs outside London and especially in *Southern England & Midlands* can be further discouraged from applying for finance in response to Brexit. These findings expand the recent work of Lee and Brown ((2016)) and Zhao and Jones-Evans ((2016)) as they provide further evidence of the importance of the regional dimension not only for access to finance, but also for growth expectation of SMES in the UK during periods of uncertainty.

[insert Table V about here]

C. Sales Decrease & Employment Cut

As an additional investigation, we rerun our analysis by considering the expectation of sales decrease and employment cuts (in terms of number of employees and amount of working hours) as a change of strategy in response to Brexit. We focus on sales expectation and employments cut because they both represent two important elements of SMEs' growth (Achtenhagen et al., 2010; Cowling et al., 2015). Furthermore, the employment cuts can

eventually damage the whole economy. In fact, small firms decisively contribute to the economy in terms of employment and productivity [5].

Recently, Cowling et al. ((2015)) have shown that SMEs in the UK have been negatively affected in their capability of growth in terms of sales during the GFC. However, they find that firms have been creating more jobs as the recession continued. The authors suggest that SMEs could be more resilient and capable of creating more jobs than large firms during recession periods. Moving from these considerations, we extend our analysis by providing nuanced evidence on whether and which SMEs expect to experience a drop in sales or have already cut the employment in response to Brexit.

Particularly, we examine: i) the association between the expectation of being more financially constrained, the expectation of a sales decrease, and changing strategies; ii) the association between the expectation of being more financially constrained, the expectation of growth, and employment cut. Thus, in this analysis we introduce two new dependent variables: *Sales decrease expectation* and *Employment cut*. Particularly, *Sale decrease expectation* is a dummy variable that takes a value equal to 1 if a SME expects to experience a drop in sales in response to Brexit, otherwise it is zero. Instead, *Employment cut* is a dummy variable that takes a value equal to 1 if the SME has already cut its employment (in terms of number of employees and amount of working hours) in response to the Brexit, otherwise it is zero.

Our findings show that firms in the manufacturing and other services sector do not expect to have a sale decrease as the coefficient for these two variables is negatively and significantly related to *Sales decrease*. We did not find evidence of any specific firm characteristic associated to the expectation of sale decrease. In addition, it seems that there is no correlation between the sales decrease and the change of strategies as $\rho_{v2,v3}$ is not significant. Part of this result can also be driven by the fact that we have several missing observations as some firms did not answer the question/ did not have an opinion concerning sales expectation after Brexit. As concerns employment cuts we find strong evidence that firms located in London and innovative firms have already cut their employment. These firms are also concerned about their projected growth even though they do not expect to face more financial constraints. The coefficients for these two variables are positive and significant and respectively equal to β=0.542 (p-value: 5%) and β=0.303 (p-value: 1%).

Consistently with the results in Table IV, we find that export-oriented firms, *Export-oriented*, have already cut their employment and expect to grow less despite not being concerned about future access to debt finance. Interestingly, small firms with a low Turnover ($\leq$ £50K) have already cut their employment. We also find a positive coefficient (β=0.308,

[5]See "Business Population Estimates for the UK and Regions 2017" for more details.

p-value: 1%) for young firms, *Firm age(≤ 5 Years)*. It is plausible that young firms have already cut their employment as they could be more concerned about their survival than growth in a period of uncertainty. We also find that the coefficients of *Manufacturing sector* and *Other Service* are both negatively and significantly related to employment cuts. Again, this provides further evidence that SMEs in the manufacturing sectors are not concerned about Brexit. Finally, we find a positive and significant association between the expectation of being more financially constrained, less growth, and employment cuts. In particular, $\rho_{v1,v3}$, $\rho_{v2,v3}$ and $\rho_{v1,v3}$ are in fact positive and significant at 1% (respectively equal to 0.35, 0.36 and 0.63).

Overall, our results suggest that innovative SMEs can be more vulnerable during period of uncertainty and therefore more willing to reduce their employment even though such a trend could reverse in the medium term. However, as pointed out by Pal et al. ((2014)) and Sullivan-Taylor and Branicki ((2011)), SMEs need to get access to financial resources to effectively be able to manage uncertainty. Therefore, regulators could keep this in mind in order to improve SMEs' resilience to uncertainty.

[insert Table VI about here]

V. Conclusion

This paper provides nuanced evidence on whether innovative SMEs anticipate to be more financially constrained and to grow less after Brexit compared to other firms. Using a unique survey, the results show that during periods of uncertainty, innovative SMEs expect to be more financially constrained after Brexit. In addition, innovative firms and firms in London have already changed their strategies. Particularly, innovative firms have already significantly cut their employment compared to less innovative firms despite the fact they do not expect a sales decrease. By focusing on the regional dimension, our findings show that innovative firms located outside of London are significantly concerned about their access to finance and future growth. Such an effect is stronger for firms located in *Southern England & the Midlands*. For this subgroup, we find a strong positive association between the expectation of being more financially constrained, growing less, and changing strategies.

Our findings have important implications for UK policy makers. Policies aimed at reducing uncertainty and increasing the demand and supply of finance for innovative SMEs in specific sectors and locations identified here could ameliorate some of the negative consequences that Brexit may have for the UK economy. In particular, policy makers should promote a more heterogeneous banking and financial system to make local economies more stable and to satisfy a heterogeneous demand of funds. For example, the UK Government

could consider regional disparities and local industrial characteristics by offering SMEs ad-hoc financial services and products. Even tough it is widely accepted that the economic growth is more regionally grounded, policy initiatives to spur innovation and entrepreneurship are however more national oriented (Audretsch and Feldman, 2004). Instead regional innovation policy could be more effective in supporting small business innovation.

Furthermore, the risk is that the existing centralised financial and banking system with a few players will keep creating inequalities between regions and spatial bias in the flows of capital to industrial firms, particularly to SMEs. Aside from the traditional banking system, alternative financial sources appear in fact to be also precluded to SMEs located outside London. For example, equity investment, peer-to-peer lending and crowfunding are heavily skewed to London and South East (Wood and Budhwar, 2017). Overall, without the co-presence and network of various financial players and channels, SMEs, and especially innovative ones, could be more discouraged from applying for financial sources as they are more pessimist about their successful chances of being granted external financial sources. The risk is to further weaken small and innovative firms that are located outside of London or more peripheral regions as they will have undoubtedly less opportunity of participation in the lending and financial market. Furthermore, policy makers could take actions aimed at improving financial products and services more resilient to Brexit or uncertainty scenarios, such as the private equity market (Wright et al., 2016). Finally, regulators should pay attention to labour market regulation with the scope to support employment relations and to contrast the trend of innovative firms to cut employment. The lack of investment in human capital could in fact further undermine the competitive base of firms in the medium and long terms (Wood and Budhwar, 2017).

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Table I

Variable Definitions

This table presents the variable definitions.

Variables	Definition
Firm age($\leq$ 5 Years)	Dummy variable taking value 1 if the firm's age is less than 5 years, and 0 otherwise.
Firm age($\geq$ 10 Years)	Dummy variable taking value 1 if the firm's age is longer than 10 years, and 0 otherwise.
Export-oriented	Dummy variable taking value 1 if the firm has export in the last 3 years, and 0 otherwise.
Business service	Dummy variable taking value 1 if the firm is in the sector of business service, and 0 otherwise.
Other service	Dummy variable taking value 1 if the firm is in the other (non-business) service sector, and 0 otherwise.
Manufacturing sector	Dummy variable taking value 1 if the firm is in the manufacturing sector, and 0 otherwise.
Sole proprietorship	Dummy variable taking value 1 if the firm's structure is sole proprietorship with no employees, and 0 otherwise.
Micro firm	Dummy variable taking value 1 if the number of the firm's employees is within the range of 1 to 9, and 0 otherwise.
Small firm	Dummy variable taking value 1 if the number of the firm's employees is within the range of 10 to 49, and 0 otherwise.
Turnover($\leq \pounds 50K$)	Dummy variable taking value 1 if the firm's turnover is less than £50,000 in the past 12 months, and 0 otherwise.
Turnover($\geq \pounds 10M$)	Dummy variable taking value 1 if the firm's turnover is more than £10 million in the past 12 months, and 0 otherwise.
Location(London)	Dummy variable taking value 1 if the firm is located in London, and 0 otherwise.
Location(Northern England)	Dummy variable taking value 1 if the firm is located in the Northern England, and 0 otherwise.
Innovation	Dummy variable taking value 1 if the firm introduced new goods/services or significantly improved any goods and services/processes over the last three years, and 0 otherwise.

Table II

Summary Statistics

This table presents the summary statistics of the firm level characteristics.

	A: View on access to debt finance (%)		
A lot easier	1.56		
A little easier	5.67		
No impact	42.97		
A little more difficult	37.06		
A lot more difficult	12.74		
Obs.	1,217		
	B: Firm level characteristics		
	Mean	S.D.	Obs
Firm age($\leq$ 5 Years)	0.138	0.345	1,535
Firm age($\geq$ 10 Years)	0.704	0.457	1,535
Export-oriented	0.276	0.447	1,535
Business service	0.299	0.458	1,535
Other service	0.197	0.398	1,535
Manufacturing sector	0.163	0.369	1,535
Sole proprietorship	0.305	0.461	1,535
Micro firm	0.380	0.485	1,535
Small firm	0.203	0.403	1,535
Turnover($\leq$ £50K)	0.212	0.409	1,535
Turnover($\geq$ £10M)	0.048	0.214	1,535
Location(London)	0.109	0.311	1,535
Location(Northern England)	0.315	0.465	1,535
Innovation	0.455	0.498	1,535

Table III

Correlation Matrix

This table presents the correlation matrix of the independent variables.

	Age≤ 5	Age≥ 10	Export	Bus.	Oth.	Man.	Sole	Micro	Small	$\leq 50K$	$\geq 10M$	London	Northern Engla
Age≤ 5	1.00												
Age≥ 10	-0.62	1.00											
Export	0.04	-0.02	1.00										
Business service	-0.01	-0.08	0.11	1.00									
Other service	-0.01	0.01	-0.13	-0.32	1.00								
Man. service	-0.01	0.08	0.17	-0.29	-0.22	1.00							
Sole	0.06	-0.09	-0.15	0.08	0.08	-0.12	1.00						
Micro	0.09	-0.10	0.04	0.01	-0.06	0.03	-0.52	1.00					
Small	-0.08	0.11	0.06	-0.05	-0.04	0.07	-0.33	-0.40	1.00				
Turnover$\leq$ £50K	0.08	-0.09	-0.16	0.06	0.14	-0.07	0.55	-0.22	-0.23	1.00			
Turnover$\geq$ £10M	-0.07	0.10	0.09	-0.07	-0.04	0.04	-0.14	-0.17	-0.04	-0.12	1.00		
Loc. (London)	0.03	-0.03	0.09	0.10	0.03	-0.09	-0.00	0.02	-0.03	-0.03	0.06	1.00	
Loc. (Northern England)	-0.01	0.02	-0.09	-0.04	0.01	0.02	0.03	-0.06	0.01	0.05	-0.02	-0.24	1.00
Innovation	0.10	-0.13	0.28	0.03	-0.04	0.09	-0.13	0.04	0.07	-0.12	-0.02	0.03	-0.04

Table IV
Access to finance and growth of innovative SMEs

This table examines the characteristics of the SMEs that: i) expect to be less successful in obtaining external finance after Brexit referendum, *Diff*; ii) expect to grow less, *Growth*; iii) have already changed their strategies, *Change*; The standard errors are in parentheses and are clustered at the sector level. Statistical significance of 1%, 5%, and 10% is indicated by ***, **, and * respectively.

	Model 1	Model 2	Model 3		
Dependent variable:	Scale of Diff.	Scale of Diff.	Diff.=1	Growth=1	Change=1
Firm age($\leq$ 5 Years)	0.240***	0.226**	0.175**	0.041	0.136
	(0.09)	(0.10)	(0.08)	(0.15)	(0.18)
Firm age($\geq$ 10 Years)	0.099	0.109	0.069	-0.170***	-0.053
	(0.06)	(0.08)	(0.08)	(0.06)	(0.13)
Export-oriented	-0.091***	-0.143**	-0.237***	0.148*	0.424***
	(0.03)	(0.07)	(0.04)	(0.09)	(0.04)
Business Service	0.053	0.021	0.036	-0.076	-0.259*
	(0.04)	(0.03)	(0.06)	(0.14)	(0.15)
Other Service	0.183***	0.251***	0.159***	-0.069	-0.286**
	(0.04)	(0.03)	(0.06)	(0.14)	(0.14)
Manufacturing sector	-0.131***	-0.173***	-0.138***	-0.269**	-0.237*
	(0.03)	(0.02)	(0.05)	(0.14)	(0.14)
Sole proprietorship	0.0224	0.132	-0.015	-0.114	-0.207*
	(0.08)	(0.16)	(0.12)	(0.08)	(0.12)
Micro firm	0.153**	0.293**	0.134	0.027	-0.134
	(0.06)	(0.13)	(0.10)	(0.13)	(0.13)
Small firm	0.153	0.176	0.133	-0.000	-0.198**
	(0.10)	(0.17)	(0.12)	(0.14)	(0.08)
Turnover ($\leq$ £50K)	-0.044	-0.151	-0.137	-0.077	-0.271
	(0.09)	(0.11)	(0.10)	(0.13)	(0.19)
Turnover ($\geq$ £10M)	0.002	0.074	-0.109	0.047	-0.240
	(0.15)	(0.17)	(0.20)	(0.34)	(0.38)
Location(London)	0.197***	0.241***	0.291***	0.267***	0.323***
	(0.07)	(0.09)	(0.09)	(0.08)	(0.11)
Location(Northern England)	0.161***	0.225***	0.249***	0.007	0.010
	(0.06)	(0.08)	(0.09)	(0.04)	(0.09)
Innovation	0.119**	0.142**	0.191***	0.221**	0.353***
	(0.05)	(0.06)	(0.03)	(0.11)	(0.07)
Constraints	-	0.050	-	-	-
		(0.14)			
Constant	-	-	-0.221	-0.507**	-1.024***
			(0.15)	(0.22)	(0.33)
$\rho_{v1,v2}$	-	-		0.38***	
$\rho_{v1,v3}$	-	-		0.36***	
$\rho_{v2,v3}$	-	-		0.54***	
Obs	1,210	774		1,132	

Table V
Regional subsamples

This table examines the characteristics of the SMEs that: i) expect to be less successful in obtaining external finance after Brexit referendum, *Diff*; ii) expect to grow less, *Growth*; iii) have already changed their strategies, *Change*. The standard errors are in parentheses and are clustered at the sector level. Statistical significance of 1%, 5%, and 10% is indicated by ***, **, and * respectively.

	1: London			2: Southern England & Midlands			3: Northern England		
Dependent variable:	Diff.=1	Growth=1	Change=1	Diff.=1	Growth=1	Change=1	Diff.=1	Growth=1	Change=1
Firm age($\leq$ 5 Years)	-0.310	-0.761***	-0.843	0.071	0.231	0.296	0.547**	-0.055	0.163
	(0.46)	(0.21)	(0.85)	(0.18)	(0.25)	(0.22)	(0.24)	(0.28)	(0.22)
Firm age($\geq$ 10 Years)	0.082	-0.179	0.136	-0.015	-0.254***	-0.240	0.203	0.027	0.312**
	(0.31)	(0.11)	(0.10)	(0.15)	(0.09)	(0.19)	(0.15)	(0.07)	(0.15)
Export-oriented	-0.733**	-0.271	0.342	-0.174	0.110	0.336***	-0.169	0.444***	0.638***
	(0.34)	(0.40)	(0.26)	(0.11)	(0.09)	(0.18)	(0.20)	(0.12)	(0.09)
Business Service	0.606***	-0.035	-0.166	0.028	-0.025	-0.141	-0.129	-0.068	-0.412***
	(0.19)	(0.23)	(0.42)	(0.05)	(0.16)	(0.12)	(0.16)	(0.12)	(0.15)
Other Service	0.555***	-0.178	-0.583	0.051**	-0.129	-0.222*	0.325**	0.124	-0.266
	(0.16)	(0.15)	(0.41)	(0.02)	(0.16)	(0.13)	(0.17)	(0.11)	(0.17)
Manufacturing sector	0.338**	-0.179	0.500	-0.134***	-0.201	-0.033	-0.270**	-0.348***	-0.738***
	(0.16)	(0.16)	(0.42)	(0.04)	(0.14)	(0.10)	(0.12)	(0.11)	(0.18)
Sole proprietorship	-0.066	-0.431	0.444	0.145	0.001	-0.384*	-0.262	-0.027	-0.166
	(0.50)	(0.76)	(0.75)	(0.16)	(0.38)	(0.22)	(0.29)	(0.46)	(0.49)
Micro firm	-0.139	-0.239	0.180	0.214	0.098	-0.378*	0.060	0.147	0.241
	(0.43)	(0.48)	(0.28)	(0.17)	(0.20)	(0.20)	(0.26)	(0.43)	(0.29)
Small firm	-0.256	-0.586	-0.256	0.227	0.172	-0.337*	0.051	-0.094	-0.208
	(0.60)	(0.75)	(0.22)	(0.21)	(0.27)	(0.19)	(0.29)	(0.26)	(0.21)
Turnover ($\leq$ £50K)	-0.255	0.041	-0.557*	-0.160	-0.097	-0.283*	-0.037	-0.113	-0.205
	(0.29)	(0.17)	(0.29)	(0.11)	(0.09)	(0.17)	(0.09)	(0.31)	(0.44)
Turnover ($\geq$ £10M)	-0.013	0.343	0.518	0.014	0.307	-0.391	-0.343	-0.449	-0.572
	(0.61)	(0.75)	(0.32)	(0.40)	(0.26)	(0.45)	(0.24)	(0.59)	(0.71)
Innovation	0.470	0.272	0.356	0.165**	0.234**	0.379***	0.152***	0.242	0.389*
	(0.54)	(0.19)	(0.26)	(0.08)	(0.11)	(0.10)	(0.06)	(0.24)	(0.24)
Constant	0.081	0.210	-1.009**	-0.223**	-0.589*	-0.810*	0.004	-0.732***	-1.382***
	(0.71)	(0.66)	(0.49)	(0.10)	(0.34)	(0.45)	(0.25)	(0.29)	(0.32)
$\rho_{v1,v2}$		0.04			0.34***			0.40***	
$\rho_{v1,v3}$		0.21			0.20*			0.51***	
$\rho_{v2,v3}$		0.19			0.46***			0.58***	
Obs		122			661			349	

Table VI
Sales and employment subsamples

This table examines the characteristics of the SMEs that: i) expect to be less successful in obtaining external finance after Brexit referendum, *Diff*; ii) expect to have sales decreases, *Sales decrease*; iii) have already changed their strategies, *Change*; iv) have already cut the employment, *Employment cut* (in terms of number of employees and amount of working hours). The standard errors are in parentheses and are clustered at the sector level. Statistical significance of 1%, 5%, and 10% is indicated by ***, **, and * respectively.

	1: Sales decrease			2: Employment cut		
Dependent variable:	Diff.=1	Sales decrease=1	Change=1	Diff.=1	Growth=1	Employment cut=1
Firm age($\leq$ 5 Years)	0.215*	-0.046	0.082	0.154***	-0.037	0.387***
	(0.13)	(0.21)	(0.16)	(0.05)	(0.16)	(0.05)
Firm age($\geq$ 10 Years)	0.069	0.026	-0.095	0.052	-0.178**	-0.050
	(0.08)	(0.13)	(0.19)	(0.08)	(0.07)	(0.06)
Export-oriented	-0.309***	-0.206	0.263***	-0.228***	0.209**	0.262**
	(0.08)	(0.20)	(0.11)	(0.04)	(0.09)	(0.11)
Business Service	0.190***	0.011	-0.083	0.044	-0.055	-0.254*
	(0.03)	(0.05)	(0.13)	(0.06)	(0.16)	(0.14)
Other Service	0.350***	-0.160**	-0.273*	0.151***	-0.050	0.040
	(0.01)	(0.07)	(0.16)	(0.05)	(0.16)	(0.12)
Manufacturing sector	0.121***	-0.677***	-0.274**	-0.170***	-0.223	-0.682***
	(0.05)	(0.02)	(0.14)	(0.05)	(0.15)	(0.11)
Sole proprietorship	-0.043	-0.147	-0.315	-	-	-
	(0.14)	(0.32)	(0.27)			
Micro firm	-0.119	-0.154	-0.270	0.123*	0.086	0.173
	(0.10)	(0.20)	(0.24)	(0.07	(0.10)	(0.11)
Small firm	-0.045	-0.218	-0.506	0.136	0.064	0.321***
	(0.26)	(0.35)	(0.33)	(0.11)	(0.10)	(0.32)
Turnover ($\leq$ £50K)	-0.222***	0.045	-0.349	-0.146	-0.075	-0.440**
	(0.08)	(0.08)	(0.39)	(0.13)	(0.12)	(0.21)
Turnover ($\geq$ £10M)	-0.641	-0.445	-0.310	-0.093	0.171	-0.091
	(0.44)	(0.31)	(0.51)	(0.15)	(0.35)	(0.32)
Location(London)	0.231***	-0.008	0.033	0.248**	0.215***	0.542**
	(0.06)	(0.32)	(0.25)	(0.11)	(0.07)	(0.22)
Location(Northern England)	0.162*	-0.207	0.014	0.236**	0.057	0.047
	(0.10)	(0.13)	(0.10)	(0.10)	(0.05)	(0.09)
Innovation	-0.116	0.204	0.162	0.189***	0.240***	0.303***
	(0.09)	(0.20)	(0.11)	(0.03)	(0.08)	(0.06)
Constant	0.444*	0.747**	-0.209	-0.218	-0.658***	-1.937***
	(0.25)	(0.31)	(0.42)	(0.16)	(0.25)	(0.15)
$\rho_{v1,v2}$		0.20***			0.35***	
$\rho_{v1,v3}$		0.20**			0.36***	
$\rho_{v2,v3}$		0.12			0.63***	
Obs		399			1,075	